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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/520,633	07/26/2005	Yuji Takakuwa	8060-1014	5936

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EXAMINER	
BURKHART, ELIZABETH A	
ART UNIT	PAPER NUMBER
1792	

NOTIFICATION DATE	DELIVERY MODE
12/31/2009	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

DocketingDept@young-thompson.com

Office Action Summary	Application No.	Applicant(s)	
	10/520,633	TAKAKUWA, YUJI	
	Examiner	Art Unit	
	Elizabeth Burkhart	1792	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *04 September 2009*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *2-24* is/are pending in the application.

4a) Of the above claim(s) *24* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *2-23* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

1. Claims 2-24 are pending in the application. Claim 24 has been withdrawn from consideration as being drawn to a nonelected invention. The amendment filed 9/4/2009 has been entered and carefully considered.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

The factual inquiries set forth in *Graham* **v.** *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

2. Claims 2, 7-11, 16, and 20-23 are rejected under 35 U.S.C. 103(a) as being unpatentable over Yamazaki ('610) in view of Motoyama et al (JP 2002-075876) and as evidenced by Zhang et al.

Yamazaki teaches a surface treating method wherein a semiconductor substrate is placed in a process chamber, pressure is maintained within the claimed range, ultraviolet light is irradiated from a light source housed in the process chamber having a light output window (quartz), and a process gas is supplied into the process chamber to

treat the surface of the substrate. The UV light is generated using a low pressure mercury lamp. The process gas comprises silane or polysilanes and ammonia or hydrazine for forming a SiN film on the substrate (Abstract, Fig. 1, Col. 2-Col. 3).

Yamazaki does not teach applying a negative bias voltage to the substrate.

Motoyama teaches a similar surface treating method (photo-CVD) wherein a semiconductor substrate is placed in a chamber, the pressure is maintained within the claimed range, UV light is irradiated from a light source housed in the chamber having a quartz window, a process gas is supplied to treat the surface of the substrate, and a plasma is produced in the vicinity of the surface of the substrate. The surface treatment may be the deposition of a silicon nitride film. A negative bias is applied to the substrate in order to increase the generation rate of film formation and improve the film quality (Abstract, Fig. 1 and 2, [0010]-[0021], [0037] of machine translation).

It would have been obvious to one of ordinary skill in the art at the time of invention by applicant to apply a negative bias to the substrate as suggested by Motoyama in the process of Yamazaki in order to increase the generation rate of film formation and improve the quality of the film.

Regarding Claims 21-23, the specification discloses that ultraviolet in the 3-10 eV energy region can be generated by low-pressure mercury lamps (p. 2, par. 5), thus the low pressure mercury lamp of Yamazaki would inherently produce UV having a photon energy within the claimed range. Also, the Xe lamp of Motoyama emitting short wavelength radiation [0019] would have a photon energy within the claimed range as evidenced by Zhang et al (p. 2964, col. 2, p. 2965, col. 2). Further the instant

specification defines "conductive substrate" to include wideband gap semiconductors that are not conductive in room temperature but become conductive at high temperatures. Yamazaki and Motoyama disclose using a silicon substrate. Silicon is not conductive at room temperature but becomes conductive at higher temperatures. Thus, it would have been obvious to use other semiconductor substrates exhibiting similar properties, such as wideband gap semiconductors, especially since Yamazaki discloses that the substrate may be a substrate that has a semiconductor element formed thereon (Col. 1, line 30).

Regarding Claims 7, 11, 22, and 23, Motoyama discloses that a mesh electrode may be placed between the light source and substrate and a bias voltage, negative on the substrate side, is applied between said electrode and the substrate [0016]-[0017].

Thus, claims 2, 7-11, 16, and 20-23 would have been obvious within the meaning of 35 USC 103 over the combined teachings of Yamazaki and Motoyama.

3. Claims 3, 12, and 17 are rejected under 35 U.S.C. 103(a) as being unpatentable over Yamazaki ('610) in view of Motoyama et al (JP 2002-075876) as applied above and further in view of Ray et al.

Yamazaki and Motoyama do not disclose that the process gas contains carbon and hydrogen and a diamond-like carbon film is formed.

Ray teaches that diamond like carbon (DLC) films may be formed on a substrate by photochemical vapor deposition wherein low pressure mercury lamps are used to irradiate a process gas containing carbon and hydrogen (Abstract, p. L1559).

It would have been obvious to one of ordinary skill in the art at the time of invention by applicant to modify the photochemical vapor deposition process of Yamazaki by using a process gas containing carbon and hydrogen as suggested by Ray in order to form a DLC film on the substrate.

Thus, claims 3, 12, and 17 would have been obvious within the meaning of 35 USC 103 over the combined teachings of Yamazaki, Motoyama, and Ray.

4. Claims 4, 5, 13, 14, 18, and 19 are rejected under 35 U.S.C. 103(a) as being unpatentable over Yamazaki ('610) in view of Motoyama et al (JP 2002-075876) as applied above and further in view of Horioka et al ('601).

Yamazaki and Motoyama do not disclose that the process gas contains a component reactive with the substrate material and a film (oxide, nitride, or carbonized) resulting from that reaction is formed on the substrate.

Horioka teaches a method of forming an oxide or nitride film on a silicon substrate, the method comprising: introducing a process gas containing oxygen or a nitrogen-containing gas to the chamber, and irradiating said process gas using a mercury lamp such that the oxygen or nitrogen reacts with the silicon substrate to form silicon oxide or silicon nitride (Col. 3, lines 17-55, Fig. 1).

It would have been obvious to one of ordinary skill in the art at the time of invention by applicant to form the SiN film of Yamazaki by reacting the nitrogen-containing gas with the substrate as suggested by Horioka as a suitable alternative to using a silicon-containing process gas, especially since both Yamazaki and Horioka

disclose silicon substrates, ammonia or hydrazine as the nitrogen-containing gas, and irradiating the process gas with mercury lamps.

Thus, claims 4, 5, 13, 14, 18, and 19 would have been obvious within the meaning of 35 USC 103 over the combined teachings of Yamazaki, Motoyama, and Horioka.

5. Claims 6 and 15 are rejected under 35 U.S.C. 103(a) as being unpatentable over Yamazaki ('610) in view of Motoyama et al (JP 2002-075876) as applied above and further in view of Aoyama (JP 04-146620).

Yamazaki and Motoyama do not disclose that the process gas contains a non-reactive component and the collision of said component results in the flattening of the substrate surface.

Aoyama teaches flattening the surface of a semiconductor substrate by exposing said substrate to a process gas containing a non-reactive component and irradiating said process gas using a mercury lamp (Abstract, Fig. 1).

It would have been obvious to one of ordinary skill in the art at the time of invention by applicant to modify the process of Yamazaki by incorporating the process gas of Aoyama in order to flatten the semiconductor substrate surface such that a smoother film may be deposited, especially since Yamazaki teaches depositing the silicon nitride films on semiconductor substrates (Col. 1, lines 15-20).

Thus, claims 6 and 15 would have been obvious within the meaning of 35 USC 103 over the combined teachings of Yamazaki, Motoyama, and Aoyama.

Response to Arguments

6. Applicant's arguments filed 9/4/2009 have been fully considered but they are not persuasive. Applicant argues that none of the cited prior art teaches or suggests accelerating electrons emitted from a surface of a negatively biased substrate due to irradiating the substrate surface with photon energy of 3-10 eV. The examiner disagrees. The instant specification discloses that UV in 3-10 eV region is generated by a general low-pressure mercury lamp or Xe lamp (p. 2). The instant specification also discloses that electrons are emitted from the substrate surface as a result of irradiating the surface with UV in 3-10 eV region and these emitted electrons are accelerated as a result of applying a negative bias to the substrate (pp. 3 & 9). Motoyama discloses irradiating the surface of the substrate with Xe lamp and applying a negative bias to the substrate (Abstract, [0010]-[0021]). Thus, the process steps of Motoyama would inherently result in electrons being emitted from the surface of the substrate and accelerated. Also, Yamazaki discloses that a general, low-pressure mercury lamp may be used (Col. 3, line 7).

Applicant argues that Motoyama merely discloses that an excimer lamp is used without any evidentiary support that the process provides for irradiating the surface of the substrate with the photon energy as claimed. The examiner disagrees. Motoyama discloses using a short wavelength Xe lamp to irradiate the substrate ([0006], [0015], [0019]) and Zhang discloses that a short wavelength Xe lamp emits UV irradiation of 7.2 eV (p. 2964, bottom col. 2 and p. 2965, top col. 2). Further, the instant specification discloses that gas molecules used in many processes hardly show photoabsorption in

the photon energy range of 3-10 eV (bottom p. 4). Therefore, Zhang provides evidentiary support that the Xe lamp of Motoyama irradiates the substrate with a photon energy within the claimed range of 3-10 eV without a decrease in intensity due to photoabsorption by the gas molecules.

Conclusion

7. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Elizabeth Burkhart whose telephone number is (571)272-6647. The examiner can normally be reached on M-Th 7-5:30.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Timothy Meeks can be reached on 571-272-1423. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Elizabeth Burkhart/
Examiner, Art Unit 1792

/Timothy H Meeks/
Supervisory Patent Examiner, Art Unit 1792